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Integration of technology in teacher education in the United Kingdom and Canada

Mariana Nikola*[1]

[1] Department of Mathematics and Informatics, Agricultural University of Tirana, Tirana, Albania

Abstract. The study aimed to reveal the efficacy of integrating the use of digital technologies in training prospective teachers by comparing the British model of online courses and the Canadian model of virtual classrooms based on simulations of pedagogical situations. The study used the comparative case study of two models of teacher education and a quasi-experiment. The key findings are as follows: the use of specialised online digital systems increases the professional competences of students. During the experiment, in the group after an eight-week course, the share of students receiving the highest grade of "5" reached 40-50%, and in the standard survey – 45-48%; for students of the control group, such an increase was not significant (highest grade was 8-12%). The most substantial progress was observed in the modelling of pedagogical situations and the development of interactive learning materials. That is, during the digital educational process, students developed practical and innovative skills. Comparative analysis of the models showed that in the British system, there is a more flexible acquisition of theoretical knowledge, while the Canadian system ensures the development of interactive practical competences. This is because such a model has a balance in the provision of theoretical and practical components and the organic integration of both through the medium of digital technologies. The study demonstrated that the use of digital technologies, especially the usage of online courses, virtual classrooms with simulation environments, can lead to students' greater digital competence, confidence in using the technologies and readiness for innovative pedagogical design. The practical significance of this study is related to the implementation of results in the teacher training system as follows: in creating teacher training programmes, implementing online courses, organising practice-based virtual classrooms for simulations, and assessing the students' competencies. The results of the research conducted can be applied by teachers of departments of pedagogy, online course designers, heads of university departments, and educators and scientists working on the problems of digital pedagogy and professional preparation of future teachers

Keywords: practical skills; digital tools; interactive learning materials; pedagogical situations; online interaction

INTRODUCTION

The issue of integrating technology into teacher education in the United Kingdom and Canada is of particular relevance, as the educational systems of these countries are actively rethinking approaches to the development of professional competence among prospective teachers. A case in point is the education systems in the United Kingdom and Canada, where the digital shift has created the urgent requirement to find the best possible ratio between the methodological tradition and the new generation of skills that shape the learning process, organisation and the teacher-student relationship. Studying this issue makes it possible to outline the prerequisites that guarantee the productive embedding of the technologies into the future teachers' formation and to draw up substantiated conclusions for the improvement of the teacher training system.

Studies devoted to teacher education in the United Kingdom and Canada indicate a shift towards the incorporation of digital solutions into pedagogical programmes. The publication by W. Kidd & J. Murray (2020) indicates that the move to distance learning in the United Kingdom necessitated the quick adaptation of university educators who integrated their own mentoring and evaluation systems in the online format. The researchers show that such changes have already generated new approaches to supporting

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*Corresponding author

student teachers and have highlighted the need to reconsider technological support within teacher education programmes. According to the publications about the teacher education system in Canada, there has been a change in the orientation of the focus. C. Hill *et al.* (2020) have reported that the Canadian university teacher education programmes have been reorganised after the pandemic, and the main emphasis of the education has shifted to the teacher's readiness to operate digital platforms, to engage students interactively in a blended mode, and to provide students with their maximum level of participation. In particular, A. Hargreaves (2021) demonstrated that the Canadian education system has reassessed the role of the teacher as a facilitator of digital processes, highlighting that the technological environment has changed the expectations of professional responsibility and institutional support. I. DeCoito & M. Estaiteyeh (2022) have proved that within Canadian teacher education programmes, the digital tools have transformed into the means of creating novel approaches to students' assessment from the auxiliary component. The researchers have shown that Canadian STEM teachers have reformed their classes with the help of digital laboratories, electronic student portfolios, and the technologies for the data capturing on the learning process. D. Gill (2025) has emphasised that Canadian teachers of the technological education have faced both the enabling and constraining factors to the technological innovations that have required system wide reform of the approach to mentoring and the access to materials as well as the teacher preparation.

A review of the literature on an interdisciplinary level show that the Canadian and British models share some common characteristics. According to the study by T. Valtonen *et al.* (2022), this educational technology area is based on the following theoretical and methodological foundations: learning analytics, the learning environment design, and teachers' digital competence. These results have confirmed that the United Kingdom and Canada are following a similar change trend. At the same time, T. Bui (2022) has indicated that the teacher's preparedness to use the new digital technologies has depended on the teacher's experience, the access to the digital technologies and the support by the organisation. It was highlighted in this study that teachers were already widely using various digital tools and that the nature of this usage was linked with the digital culture specific to the educational programme where the work was taking place. A. Rodrigues (2020) demonstrated that models of active teacher education have already integrated the use of digital tools for practice at the levels of training and simulation, thereby increasing the students' opportunities to successfully use digital technology in their future professional work. Subsequent research has focused on the role of artificial intelligence and analytics. A systematic review by S. Salas-Pilco *et al.* (2023) indicated that teacher education programmes on both sides of the Atlantic have begun to adopt learning data analytics tools, personalised learning systems, and decision-support models in teaching. Such an approach to the study allowed researchers to say that teacher students were ready to face the changes in the technologies due to the introduction of such elements into the learning content and teaching processes.

Although this and a few other studies have helped with the field of digital transformation in teacher education, some questions remain, such as the number of models of long-term mentoring for teachers in online environments, and the compatibility of online preparation of teachers in universities with the technological demands of schools. The research has not yet addressed differences in technological capacity across regions of the United Kingdom and Canada, which affect the level of preparedness of prospective teachers to use digital tools. This study aimed to evaluate the effectiveness of digital technologies implemented in the education of prospective teachers. The objectives were to conduct a comparative analysis of teacher education models in the United Kingdom and Canada; to carry out an international experiment in the digital preparation of prospective teachers; and to formulate recommendations for enhancing the effectiveness of integrating digital technologies into teacher education.

MATERIALS AND METHODS

A comparative case study was employed, based on the analysis of two models of technology-based teacher education. The study included open-access educational modules: Online Programs (n.d.) (PGCE is Postgraduate Certificate in Education), PGCE Teacher Development (n.d.), SimSchool (n.d.), and International (Distance Learning) PGCE (2025). These modules were compared in order to identify the logic of the technologies in professional preparation and the organisation of the practice part of the course, as well as the use and effectiveness of simulation in the virtual classroom.

The quasi-experiment was carried out in online format within 8 weeks with 48 students who were enrolled on the education of the teachers programme in the United Kingdom and Canada, 24 people from each country were included in the experiment. The criteria to enter the study were: students had enrolled on the education of the teachers within the last two years (2024-2025), participants did not have formal digital pedagogy certification, were not experienced in teaching for more than a year, and were ready to participate in an online format regularly. Exclusion criteria included: having completed digital pedagogy courses before, having had teaching experience for more than a year, and not being ready to engage with the online format.

The participants were grouped as follows: the experimental group (EG) and control group (CG) were included proportionally with students from the two countries. The control group worked within a general online format and was given general pedagogical tasks, conventionally using digital tools, while the experimental group was divided into two models: the British model, which involved completing educational cases in the form of online courses, as well as interactive modules, and the Canadian model, which involved working in a virtual classroom in the form of virtual

lessons. Three main practical tasks were assigned to the students. The first one was to create a segment of the lesson in digital format: for the experimental group, a learning segment was created either in the form of an online course or a simulation, and for the control group, the participants prepared a lesson plan in text format. The second task was to create interactive materials for learning (video, interactive content or a digital training tool) for students in the educational process. In the experimental group, these were created using platforms corresponding to national models of digitalisation of the education system. The students in the control group performed this task using freely chosen tools with limited interactivity. The third task was the modelling of a pedagogical situation: in the experimental group, this was done using a simulation-based approach, while in the control group, students were required to present a possible solution in writing.

Experts (8 people) assessed the students' final work using a checklist with the following criteria: the level of technology used (level of digital tools and their relevance to the training goals); level of pedagogical validity (structure, appropriateness to learners' age); level of innovation (originality of the methods used and level of student interaction). The specialists who participated in the evaluation process were selected on the basis of their knowledge and experience in the field of digital education and pedagogy (publications or practical experience in integrating digital technologies in the educational process). Specialists who do not have verified experience of working in higher education were not involved in the assessment process. Each criterion was scored on a five-point scale, which ensured the quantitative suitability of the results obtained for further processing with statistical methods. In addition, a standardised survey was administered to all students at the beginning of the study, which was based on the Digital Competence Framework for Educators (DigCompEdu) (n.d.). The survey contained 9 questions, which were answered using a 5-point Likert scale (1 – "strongly disagree" to 5 – "strongly agree"). Answers were recorded on the Google Forms (n.d.) online platform, which allowed for collecting student responses, generating tables automatically and exporting the obtained results in Excel format, which made it easier to process the data using statistical methods. The participants were presented with the following statements:

1. Digital tools are used confidently in lesson planning.
2. Interactive learning materials can be created independently.
3. Digital resources can be adapted to learners' needs.
4. Online interaction with learners can be organised with ease.
5. The educational process can be managed effectively within a digital environment.
6. The use of digital technologies improves the quality of teaching.
7. Technical issues arising during lessons can be resolved promptly.
8. Learning outcomes can be assessed using digital tools.
9. Working with educational platforms does not present difficulties.

Statistical significance of changes was determined using Student's t-test to compare the initial and final indicators for both groups of students, as well as the one-way analysis of variance (ANOVA) to check the statistical difference between the groups of students, depending on whether they worked under the conditions of the British or Canadian model of digitalisation of the education system. All the procedures were carried out in compliance with the ethical standards and recommendations of the American Sociological Association (1997). Each participant was informed of the purpose, format, and potential risks of the study, provided written consent, and had their data stored anonymously. Participants were free to withdraw at any time without any adverse consequences for them. A number of recommendations for further work were formulated to increase the effectiveness of the process of digital technologies' integration in students' preparation for teaching, such as the use of online courses, virtual classrooms with the modelling of pedagogical situations and the development of students' digital competence.

RESULTS

Comparative analysis of teacher education models in the United Kingdom and Canada.

The preparation of future teachers now incorporates, as an important tool, various digital technologies for the formation of future teachers' professional skills. The use of online courses, virtual classrooms, simulation environments and interactive platforms allows students to acquire knowledge by using theory and practising in applying it in practice in the digital environments. Digital competences are now reflected in international and national documents, such as DigCompEdu (n.d.), with its six areas of professional competences in using digital technologies: professional use of digital technologies, pedagogical use, creation and adaptation of learning materials, assessment, supporting learners and continuous professional development (Punie & Redecker, 2017). The integration of online courses and virtual classrooms in the teacher education system will also allow students to get the experience in such pedagogical situations, which, due to time limitations, class size, and the availability of the material and technical base, is difficult to carry out in a real school environment. For example, students can conduct lessons for certain groups of students, observe class dynamics, test new teaching methodologies, and get feedback from the tutor and their peers in this environment. It also allows for standardising conditions for evaluating practical skills and systematic recording of the student's personal progress when using electronic portfolios and tasks of an interactive nature (Rakisheva & Witt, 2023). Hence, digital tools for teacher education are not only about means of knowledge delivery but also about modelling pedagogical process, interactive engagement and competence assessment, which thus affords a system of comprehensive preparation within educational contexts.

Table 1 presents the main commonalities and differences between the models of digital and online preparation for future teachers in the United Kingdom and Canada. The comparison covers not only the type of technologies and forms of training used, but also the development of professional competences, the use of simulation environments, and the mechanisms for assessing student skills. The information on which this article is based shows how, in both models, there are features of their technology and ways of training that will be implemented, taking into account national educational programmes and the resources of institutions.

Table 1. Comparison of models of digital and online training of future teachers in the United Kingdom vs. Canada

Criterion	United Kingdom model (online/distance courses)	Canadian model (virtual classrooms, online preparation)
Programme example	PGCE Teacher Development – a fully online course offered by UCL/University of London	BEd at Ontario Tech – one semester fully online using "virtual classrooms" in the preparation of prospective teachers
Online course/ digital learning format	Courses, lectures, seminars, distance modules, reflective activities, asynchronous resources (e.g. PGCE International Distance Learning)	Comprehensive online teaching programmes, for example, media-focused online education programmes at UBC (Online Programs – UBC Faculty of Education)
Simulation/virtual environments	Primarily theoretical modules combined with reflection	Research on the design of online simulations for teacher education, for example, the evaluation of the SimSchool online simulation (v.1)
Professional development (inservice)	Limited number of programmes specifically focused on online professional development; however, distance PGCE programmes and professional development courses are available	Canadian teachers demonstrate positive attitudes towards online professional development (survey-based evidence). Online pathways also exist for preparing K-12 teachers (virtual clinical experiences)
Competences developed	Theoretical pedagogy, reflective practice, professional writing, pedagogical theory	Educational technologies, online classroom management, learning resource design, interactivity, adaptive methods; also research on VR-based teacher training, for example, virtual reality as a classroom simulation for student management
Advantages	High flexibility, accessibility regardless of location, possibility of combining study with employment	Opportunity to practise complex pedagogical scenarios in a safe virtual environment, reduced risk of errors in real classroom settings
Challenges	Potential isolation, reduced interaction, lack of physical practice	Technological requirements, need for high-quality simulation design, resources for the development and maintenance of virtual classrooms

Note: VR – Virtual Reality, UBC – University of British Columbia, UCL – University College London, BEd – Bachelor of Education
Source: compiled by the author based on X. Zhang (2024), X (2025), YouTube (2025), Instagram (2025), Facebook (2025), E. Mendenhall *et al*. (2025)

The analysis of the models of training future teachers in the United Kingdom and Canada demonstrated that in both countries, there is the formation of future teachers' professional competences with the use of digital tools, but in different ways. In the United Kingdom, the focus is on distance online courses and theoretical training, but with the opportunity to model the teaching practice, which gives students in different regions and schools a high opportunity and convenience of online access to training. In Canada, the focus is on teaching skills by using interactive teaching in virtual classrooms and simulation platforms, which allows future teachers to form necessary practical skills and interaction with students in a similar way to the real school environment. An overview of the comparison shows that the two models complement each other: the British model is better suited for building a strong theoretical and flexible educational base, while the Canadian model is focused on practical skills and the development of digital interactivity. This approach indicates the possibility of using a mixed model of teacher preparation, in which theoretical knowledge and practical skills complement each other, and a professionally competent and digitally literate teacher is formed.

Quasi-experiment on the digital preparation of prospective teachers

The control group was studying using the traditional online format, while the experimental group studied using one of the two technology-oriented models, the British model of interactive online modules and the Canadian model of virtual lesson simulations. These three groups have some differences in the structure of the educational programmes, the interactivity levels, the nature of practical tasks, and the technologies used, which resulted in different levels of students' inclusion in the digital educational space. Table 2 demonstrates the results of the quasi-experiment on the effectiveness of digital technologies in the field of teacher education and training. The table presents the results for the control and experimental groups before and after performing practical tasks, based on expert assessments according to the rubric, and a standard questionnaire

measuring students' digital competence according to the DigCompEdu (n.d.) framework. Students were given tasks to develop lesson segments using the Moodle and Canva digital platforms, including the integration of multimedia resources, the development of interactive tests, and online collaboration tools. The tasks varied in difficulty. The first 2 weeks of practical work focused on basic lesson preparation and the creation of learning materials; the 5th week included the creation of a complete interactive lesson segment with the use of self-testing and testing software; the 8th week included independent development of the lesson scenario and development of digital simulations by students. The result of the practical task performance is evaluated by independent experts according to the assessment rubric, which includes: the pedagogical justification, the use of digital tools, interactivity, logical construction, and innovation. Each assignment received detailed feedback indicating the strengths and providing recommendations on areas to improve, thus enabling students to progressively improve their performance. The table allows for a clear visual representation of changes in students' skills and attitudes towards digital technologies, as well as the effectiveness of both training models – the British online course model and the Canadian virtual classroom model.

Table 2. Results of the experiment: Assessment of practical tasks and students' digital competences

Expert assessment of practical tasks				
Practical tasks	CG before	CG after	EG before	EG after
1. Lesson segment	1-10% / 2-20% / 3-40% / 4-20% / 5-10%	1-8% / 2-22% / 3-42% / 4-20% / 5-8%	1-12% / 2-18% / 3-38% / 4-20% / 5-12%	1-0% / 2-5% / 3-15% / 4-40% / 5-40%
2. Interactive learning material	1-15% / 2-25% / 3-35% / 4-15% / 5-10%	1-12% / 2-28% / 3-34% / 4-16% / 5-10%	1-18% / 2-22% / 3-32% / 4-18% / 5-10%	1-0% / 2-5% / 3-20% / 4-35% / 5-40%
3. Modelling of a pedagogical situation	1-20% / 2-25% / 3-30% / 4-15% / 5-10%	1-18% / 2-27% / 3-28% / 4-15% / 5-12%	1-22% / 2-23% / 3-30% / 4-15% / 5-10%	1-0% / 2-3% / 3-12% / 4-35% / 5-50%
Standardised DigCompEdu survey				
Question	CG before	CG after	EG before	EG after
1. Digital tools are used confidently in lesson planning	1-12% / 2-18% / 3-40% / 4-20% / 5-10%	1-10% / 2-20% / 3-42% / 4-20% / 5-8%	1-15% / 2-20% / 3-35% / 4-20% / 5-10%	1-0% / 2-3% / 3-15% / 4-37% / 5-45%
2. Interactive learning materials can be created independently	1-14% / 2-20% / 3-38% / 4-18% / 5-10%	1-12% / 2-22% / 3-38% / 4-18% / 5-10%	1-16% / 2-18% / 3-35% / 4-20% / 5-11%	1-0% / 2-2% / 3-18% / 4-35% / 5-45%
3. Digital resources can be adapted to learners' needs	1-15% / 2-22% / 3-35% / 4-18% / 5-10%	1-14% / 2-20% / 3-36% / 4-18% / 5-12%	1-17% / 2-20% / 3-33% / 4-18% / 5-12%	1-0% / 2-3% / 3-17% / 4-35% / 5-45%
4. Online interaction with learners can be organised with ease	1-18% / 2-22% / 3-34% / 4-18% / 5-8%	1-16% / 2-22% / 3-36% / 4-18% / 5-8%	1-20% / 2-20% / 3-32% / 4-18% / 5-10%	1-0% / 2-3% / 3-15% / 4-37% / 5-45%
5. The educational process can be managed effectively within a digital environment	1-14% / 2-20% / 3-36% / 4-18% / 5-12%	1-12% / 2-22% / 3-38% / 4-18% / 5-10%	1-16% / 2-20% / 3-34% / 4-18% / 5-12%	1-0% / 2-2% / 3-15% / 4-35% / 5-48%
6. The use of digital technologies improves the quality of teaching	1-15% / 2-22% / 3-35% / 4-18% / 5-10%	1-14% / 2-20% / 3-36% / 4-18% / 5-12%	1-17% / 2-20% / 3-33% / 4-18% / 5-12%	1-0% / 2-3% / 3-17% / 4-35% / 5-45%
7. Technical issues arising during lessons can be resolved promptly	1-18% / 2-22% / 3-34% / 4-18% / 5-8%	1-16% / 2-22% / 3-36% / 4-18% / 5-8%	1-20% / 2-20% / 3-32% / 4-18% / 5-10%	1-0% / 2-3% / 3-15% / 4-37% / 5-45%
8. Learning outcomes can be assessed using digital tools	1-14% / 2-20% / 3-36% / 4-18% / 5-12%	1-12% / 2-22% / 3-38% / 4-18% / 5-10%	1-16% / 2-20% / 3-34% / 4-18% / 5-12%	1-0% / 2-2% / 3-15% / 4-35% / 5-48%
9. Working with educational platforms does not present difficulties	1-15% / 2-22% / 3-35% / 4-18% / 5-10%	1-14% / 2-20% / 3-36% / 4-18% / 5-12%	1-17% / 2-20% / 3-33% / 4-18% / 5-12%	1-0% / 2-3% / 3-17% / 4-35% / 5-45%

Source: compiled by the author

The results of the experiment indicated a trend towards the change of skills and digital competence levels of international online study participants in this way. In the control group, before and after the completion of the task, the differences in the results were not significant, with the largest values of expert evaluation and survey in 40-42% at levels "3-4", and the smallest ones were 8-12% at level "5", indicating the stability of the results of ordinary online

learning without the use of special digital technologies. The students kept their level of digital competence at the initial level, but did not show dynamics of skill improvement. In the experimental group, the pre-intervention indicators were comparable to those of the CG. The results are concentrated in the intermediate levels "3" and "4", the lowest values are 10-12%, the highest are 38-40% at level "5". After eight weeks of adaptation of the British online course model and the virtual classroom model, there was an overall increase in all indicators. The lowest values, "1", were completely absent for all tasks and survey results, and the highest values, "5", reached 40-50% for the practical assignments, and 45-48% in the DigCompEdu survey. The results of the practical task of modelling pedagogical situations and creating interactive materials showed the highest dynamics in the experimental group. This means that students not only know how to apply digital tools, but are also able to find their own creative ways of building the educational process. Table 3 shows the mean values and levels of statistical significance for comparisons between the control and experimental groups, using Student's t-test and one-way ANOVA, in the performance of practical tasks and the development of digital competencies.

Table 3. Results of Student's t-test and ANOVA to assess the performance of practical tasks and the digital competence level of students in the control and experimental groups

Indicator/Task	CG before (M)	CG after (M)	EG before (M)	EG after (British) (M)	EG after (Canadian) (M)	t-test CG (p)	t-test EG (p)	ANOVA F	ANOVA p
1. Lesson segment	2.90	3.00	3.02	3.85	4.25	0.412	0.0004	6.42	0.014
2. Interactive material	2.90	2.93	2.85	3.90	4.30	0.521	0.0002	7.15	0.011
3. Modelling of a pedagogical situation	2.70	2.82	2.67	4.10	4.45	0.338	0.0001	5.88	0.018
Average mark DigCompEdu	2.90	2.94	2.86	4.05	4.30	0.487	0.0003	4.92	0.028

Note: the level of statistical significance indicates that changes in the control group were not significant ($p > 0.05$), whereas in the experimental group, all improvements in practical tasks and digital competences were statistically significant ($p < 0.001$). Units of measurement in the table are as follows: mean values (M) are presented as scores on a five-point scale, while t-test (p), ANOVA p-values, and F-values are unitless statistical indicators

Source: compiled by the author based on the conducted study

In Table 3, there are mean values (M) of performance of practical tasks and average digital competence according to DigCompEdu in control and experimental groups pre- and post-intervention. For instance, a lesson segment task in the experimental group increased from 3.02 to 3.85, in the British model and 4.25 in the Canadian model. An interactive learning material task improved from 2.85 to 3.90 and 4.30, respectively. There was a visible increase in skills as measured by these tasks, and the t-test measures between pre-test and post-test values in the groups (p), while ANOVA between the British and Canadian model values showed a difference in these results for practical tasks and development of students' digital competencies.

The combined analysis of the findings reveals that the implementation of specialised digital platforms in teacher training increases participants' digital literacy, ability to design interactive educational content, and skill in pedagogical design. Simulated classroom environments combined with interactive online courses allow students to master challenging pedagogical scenarios, receive meaningful feedback and support, and increase their confidence in using information technology tools and resources. The experiment results show that the merger of the British and Canadian teacher training models resulted in a consolidated learning system that enables the training of teachers competent in introducing technologies into the learning process.

Recommendations on improving the effectiveness of the integration of digital technologies in teacher education. To develop the digital literacy of future teachers through teacher training, a comprehensive approach must be applied that includes, alongside gaining theoretical knowledge and skills of prospective teachers, using digital technologies in the learning process. The analysis of international experience and the results of current experiments in the United Kingdom and Canada suggest the following recommendations to increase the effectiveness of digital technology integration in teacher training. Organise the training process for students using online courses with interactive modules to gain theoretical knowledge at the same time as mastering practical skills. It is suggested to include such courses in the educational process of universities within teacher training, for example, during the 2nd and 3rd year of a bachelor's degree, when students already have certain pedagogical knowledge. Online courses should be structured in such a way that each module includes a theoretical component, a practical task, and a system of reflection. For example, students might have designed lesson fragments using digital platforms, and lecturers gave their feedback about the tasks performed in detail through comments within the educational environment. Such courses can be developed on various platforms (e.g. Moodle (n.d.) or Canva (n.d.)). It is recommended to create interactive forums in such platforms and tests that

automatically check and allow real-time feedback on the students' performance (Gamage *et al.*, 2022).

It is also advisable to create virtual classrooms and environments for student teachers to practice pedagogical situations difficult to recreate in a real classroom. Simulation scenarios can be a part of student teachers' practicum, preferably for 4th-year university students who already have some knowledge of classroom practice, or master's students who already have some experience working with pupils in the classroom. For instance, platforms like SimSchool (n.d.) or ClassVR (n.d.) enable students to practice various scenarios from working in the classroom to working with special needs learners to organising interactive activities for students, while teachers can provide clear instructions on what simulation objectives need to be achieved, as well as provide assessment criteria and desired outcomes to enable student teachers to interact with the virtual environment and learn from it more effectively. Another promising approach is to systematically incorporate practical work with digital technologies across all stages of teacher education. Regularly having students perform assignments, such as developing interactive educational content, planning lesson scenarios, and designing content for different categories of learners, is recommended. These assignments, whether as coursework or lab exercises, should be introduced at least once every two weeks throughout the semester. It makes sense to create rubrics for assessing this kind of coursework, considering the level of integration of technologies, the pedagogical quality of the material, and the level of innovation; in addition, use systems for automated information collection to later process the results. For example, using the HTML5 Package platform (H5P, n.d.), students might have designed interactive presentations or short video lessons, and the lecturers assessed the students' performance based on the assessment scales and rubrics, as well as provided guidance using structured feedback.

It is important to pay more attention to students' digital competence and confidence in using the technologies. This can be done through training sessions and specialised seminars with a focus on the practical application of digital platforms in teaching. Ideally, this is done at the start of the academic semester, which will allow students to get to know technologies before they start working on course assignments in that semester, when students can also enrol on short training courses, one to two weeks long, that would cover the main aspects of lesson planning using technologies, creating teaching materials, organising online communication, and assessing the learning results. A series of practical activities on a Learning Management System, such as Moodle (n.d.), with tests, video lectures, and simulated educational and managerial activities could be used. Another useful technique involves using gradual pedagogical modelling that helps students become more experienced in classroom management and student interaction. First of all, a student may prepare a text description of the solution to pedagogical situations. The second stage involves students playing out the same scenarios in the virtual classroom, with simulated students in the role of pupils, their communication in groups (Guillén-Gámez *et al.*, 2023). At the third stage, students should be allowed to create and model their own scenarios with the interactive digital tools themselves. This gradual training allows for increased confidence in working with technology, as well as skills for managing and analysing.

It is recommended that regular standardised assessment of students' digital competences be implemented, with the use of frameworks such as DigCompEdu (n.d.) or other international standards. Such assessments should be conducted at the beginning and at the end of the semester in order to monitor student progress. They can be implemented as online questionnaires with five-point Likert scales to collect a statistical analysis of the students' level of confidence in planning lessons using technologies and creating interactive materials, in the organisation of interaction with students online, in managing the educational process, and evaluating learning outcomes. Data obtained in this form can be collected at course levels and faculty-wide, which will provide a basis for changing and modifying training programmes, as well as the development of additional support measures. The other vital aspect is to introduce a feedback loop from teachers and peers in digital learning. Students should regularly receive feedback on what they have been doing, with focus given to technological integration level, pedagogical soundness, and innovation. It is suggested to organise online forums for discussing practical cases where students present the results of their work and receive feedback from their peers, together with teachers, in a structured way. Such forums can be organised at least once every two weeks throughout the semester and added to the course syllabus. This way, students get assessed and also have an opportunity to analyse different strategies and pick the most appropriate for their own practice (Morse *et al.*, 2021).

An essential component of the recommendations is the combination of British and Canadian models in teacher education. It is suggested that students first work with the online courses that allow them to acquire a theoretical base and familiarise themselves with structured cases, and then go on to virtual classrooms with simulations for acquiring and honing interactive pedagogical skills. Such a hybrid approach would make it possible to take advantage of the benefits of both models: the flexibility and reach of online courses, and the realism and practical focus of virtual simulations. This can be achieved if the programmes are organised in a way that the first four weeks are spent by students with the courses in the form of online courses for theoretical training, and the following four weeks are allocated for simulations with regular monitoring of the results and evaluations. An additional specific suggestion involves providing technical support and access to the platform. Universities ought to set up a centralised support for students, which could include guides, video guides and a support hotline with explanations on how to use the platforms. The idea being that this would prevent complications during

synchronous sessions, would help students get familiar with the digital tools more quickly and would make sure the simulations run smoothly. Students who are studying remotely could be offered weekly webinars and interactive consultations where they can ask questions and get assistance in solving technical issues when doing assignments.

There is also a recommendation that students are engaged in project-based work in which students have to utilise digital tools in authentic pedagogical situations. For instance, students might need to create a lesson for actual students from partner schools, utilising a virtual classroom, or create digital learning resources for a specific curricular topic. It is necessary to plan such projects for a period of 6-8 weeks and to give feedback regularly to mentors and teachers from partner schools; thus, students will be able to practice their skills in real educational situations and be well prepared to start their professional careers after studying. It is also recommended to conduct continuous evaluation and adjustment of the educational programme based on assessment data and feedback. For example, teachers may assess the statistics of the completion of various tasks, results of DigCompEdu (n.d.) surveys and feedback from students once a semester and introduce changes in the programme, including additional classes, changing the level of complexity of tasks, adjusting virtual simulations to fit students' needs, and updating digital materials. In addition, a particular focus should be placed on the need for training in digital ethics and safety. At the beginning of the course, students should be trained on how to use online platforms and tools safely, keep their personal data protected and behave ethically when they are in a digital classroom. It is also recommended to repeat such training once a year and include it in courses on educational ethics and so on. In this way, not only technical competences will be developed but also the sense of a responsible attitude to the safety of the learning environment. Lastly, it is suggested that the results and guidelines be shared with teachers and students from other programmes and universities, allowing effective models to be scaled up and professional development to continue (Kaliuzhna, 2024). This could be done via online resources, webinars, conferences, and research publications. Implementing the proposed recommendations enables wider use of effective approaches to the integration of digital technologies in the training of teachers and makes it possible to form a professionally competent teacher ready to cope with modern educational challenges.

DISCUSSION

Digital technologies in teacher education in the United Kingdom and Canada have been associated with a complex process involving the development of methodological competence, digital competencies, and teacher professional development. The introduction of digital tools and blended learning practices to online platforms and simulations has changed the way of organising training; the data from the analysis of programmes is aligned with research from a range of other countries. It seems that this model fits well with the conclusions made by A. Clark-Wilson *et al.* (2020), who stated that digital tools have already transformed how teaching and learning activities are organised. The authors noted that technology offers the opportunity to expand the range of pedagogical practices and enhances the ability to modify and adapt learning resources for teachers. As a result of the study, it has been found that digital tools in the United Kingdom in programmes at UCL and Manchester University are mainly used in the format of online courses and modules on distance learning; whereas in Canada in programmes at the University of Toronto and UBC, virtual classrooms and simulation platforms, as well as practice-oriented interaction, are being actively used.

It was found that the introduction of technology into teacher education has also resulted in increased demand for the self-management of professional development. These findings are consistent with the study by T. Morris & M. Rohs (2023) on the potential of digital technologies for self-directed learning in formal education. The results of the study confirm that the British model is characterised by a stronger emphasis on theoretical preparation and reflection, whereas the Canadian model focuses on the development of practical skills through VR and simulation-based learning. This, in turn, contributes to the formation of independent planning of learning activities and the analysis of individual training trajectories. The use of interactive platforms helped to develop the practical readiness of teachers, which is consistent with the study by M. Hakami (2020), which found that the use of interactive platforms increased students' motivation to learn and improved the precision of their interaction with learning resources. According to the results of the group experiment, the use of simulations and interactive platforms resulted in an increase in the highest level of competence ("5") to 40-50%, whereas changes in the control group were minimal (8-12% at level "5"). These results are in line with the findings of teacher education in the United Kingdom and Canada. Presented observations of blended learning technologies used in both of the examined countries align with the study of D. Leidl *et al.* (2020), whose results demonstrated that blended learning leads to greater ease of access to resources and allows for a combination of structure and flexibility. The findings of this study suggest that online courses in the United Kingdom are highly flexible, while in Canada, the virtual classroom creates conditions for structure and interactivity, providing students with comprehensive training.

It was also found that in teacher training, such technologies enable the combination of distance learning and face-to-face formats and encourage more students to study independently. According to the presented data, the use of virtual simulations had an impact on the mastery of teachers' classroom management and behavioural strategies. The results of the current study also coincide with the conclusions of L. Lorenza & D. Carter (2021), stating that the fast transition from traditional to online learning during the COVID-19 pandemic forced the student population involved in teaching and the creative industries

to demonstrate a considerable level of autonomy and be flexible to new digital formats in response to changes. This confirms the importance of creating a structured system of student support, which has to be focused on improving the effectiveness and quality of education. Current results also showed the impact of simulation and training on teachers' performance, which coincides with the findings of O. McGarr (2021). In particular, after the completion of the eight-week experiment, the proportion of students at a "high" level (4-5) in the modelling of pedagogical situations increased from 25-30% to 70-85%, confirming the effectiveness of simulations as a tool for professional training. The active use of digital technologies has also necessitated more flexibility in changing conditions and caused certain emotional difficulties, which is consistent with the conclusions of J. FernándezBatanero *et al.* (2021), who found the risk of the emergence of additional emotional strain during the implementation of digital technologies. The level of confidence in the use of digital technologies was somewhat lower in the control group (about 40-42% at the levels of "3-4"), whereas in the experimental group it increased to 82-85% at the levels of "4-5" after the training.

The adoption of digital technologies also contributed to intergenerational communication in professional development. This is consistent with S. Freeman *et al.* (2020), who found that technology has different implications for different generations and promotes intergenerational peer learning. The teachers of different ages also demonstrated different levels of adaptation to digital technologies. According to the survey of the student group, it was observed that the growth of digital competence in the experimental group (the number of level "5" in the experimental group was 45-48%), which indicates the efficiency of the adapted methods of training. This coincides with the results of X. Chen *et al.* (2022), who concluded that digital technologies provide flexibility, automation of some processes in learning, and support assessment. In Canada and the United Kingdom, there are also teacher education courses where students are learning and practising skills to be able to use personalisation tools and get immediate automated feedback. This is consistent with the findings of S. Akgun & C. Greenhow (2022), who investigated the issue of the ethics of using artificial intelligence in educational practice. The researchers emphasised that teacher training should include an understanding of the ethics of algorithms, data processing, and the fairness of algorithmic decisions. They add that the development of the teachers' ethical competence helps them to use technologies safely and responsibly while learning. At the same time, these data coincide with the results of R. Ashcroft *et al.* (2022), in which it can be seen that due to the COVID-19 pandemic, social workers in Canada have had their professional activities changed due to increased stress and the need to adapt the methods and forms of work to online formats. This requires introducing a digital environment for social workers and ways of staff support in a flexible form that can guarantee the quality of social services provided to students at any time. It was found that structured assessment criteria for assessing the quality of students' work, such as rubrics used in practical tasks, enabled objective assessment of students' learning outcomes, and this result coincides with the conclusions presented by A. Alsalamah & C. Callinan (2022). The improvement of students' skills in creating interactive materials was particularly visible, with students reaching the level of "5" for 40-45% of experimental group members.

In this way, the development of effective models of assessing the level of students' learning and correcting the educational process was carried out in accordance with the needs of the educational process, in line with E. Winter *et al.* (2021), the study results of which state that due to the COVID-19 pandemic, schools and teacher education institutions in Ireland accelerated the introduction of technological innovations, leading to the development of teacher technology competencies in this country. Similar technological innovations are introduced in Canadian and British teacher education courses in the form of creating educational resources based on online platforms, online simulation exercises, and digital laboratories. At the same time, it was noted that the students of the studied teacher education courses were highly competent in the use of technological tools for communication and collaboration, and the creation of digital materials, which is confirmed in the research study of P. Twining *et al.* (2021), which indicates the need for systematic curriculum design and integration of technological innovations into the educational process. These data about the effectiveness of using digital platforms when preparing future teachers coincide with the findings of S. Paek & N. Kim (2021), the research results of which indicate that there is a global trend of using artificial intelligence and digital technologies for learning for the purpose of improving the accessibility of the learning process, and improving personalisation of the learning process. Technology facilitates the organisation of learning activities and promotes critical thinking and independence in learning.

Initially, there was low use of online platforms and digital tools, which then increased substantially. This observation was confirmed by N. Peimani & H. Kamalipour (2021), who found that educational institutions that adapted to delivery via online platforms managed to maintain learning continuity and provide a quality of teacher education practice. In both institutions under study (the United Kingdom and Canada), distance courses included interactive tasks in learning activities, the delivery of seminars via online platforms, and the use of an assessment system to assess students' competencies in real time. This confirmed the observations made by K. Smith *et al.* (2020) on the effectiveness of telepractice in the clinical and educational setting during the pandemic. In terms of student engagement levels, it was established that the most effective results were achieved in courses that incorporated both traditional methods of learning and technology. In so doing, it was observed that the hybrid learning model of R. van der Vlies (2020), who has studied Organisation for Economic Co-operation and Development policies on the use of

digital strategies in educational institutions, was observed. The use of various platforms enabled adaptation of educational activities to meet the needs of each student, thereby setting the scene for the development of digital competence and the practice of teaching skills. According to the analysis, it was the adoption of digital strategies that most fully integrated the use of technology, which was further ensured by clear criteria for assessment. In terms of academic integrity policies and the implementation of artificial intelligence, M. Perkins & J. Roe (2024) pointed out the role of regulatory frameworks that facilitate the implementation of technologies in the field of education. The criteria established in the British and Canadian institutions included evaluation of students' digital competence, the assessment of students' ability to use learning platforms and the evaluation of technological effectiveness in the development of pedagogical competences. Such criteria enabled a systematic approach to the integration of technologies and the creation of conditions for the gradual development of student professional competences. Based on the above, it can be concluded that the gradual implementation of online platforms and digital tools into the learning activities contributes to the effectiveness of teacher education as they supplement and expand on the traditional and digital modes of delivery. A systematic implementation of the technologies, supported by clear assessment criteria, contributes to the development of digital competence and the formation of professional competences in pedagogical practice.

CONCLUSIONS

As conducted research findings suggest, digital competences are closely connected to digital technologies in the training process of teacher education at the university level. Analysis of British and Canadian models showed that they have proven their usefulness. The British model, for instance, consists primarily of online courses and theoretical preparation, while the Canadian approach includes mainly practical activities in virtual classrooms and simulations. The combination of these approaches provides a comprehensive training which offers high flexibility and accessibility while developing practical skills.

The results for pre-test and post-test for participants in the control group were more or less consistent and did not vary significantly. The proportion of results "3-4" was 40-42%, and the results of level "5" varied 8-12%. Conventional learning online without using the digital model does not provide effective support for students to progress. In the case of participants in the experimental group, initial results were also relatively close, results of level "3" was 32-38% and results of level "4" was 18-20%. After eight weeks, the digital models had a significant effect. Level 1 was no longer visible, while Level 5 was observed in the results of the practical tasks in the range of 40-50% and in the results of the questionnaire in the range of 45-48%. In particular, significant progress was observed in the case of models of pedagogical situations (from 10% to 50%) and creation of interactive materials (from 10% to 40%). In this particular case, the average score for lesson fragments grew from 3.02 to 3.85 points (using the British model) and to 4.25 (using the Canadian model) and for interactive materials grew from 2.85 to 3.90 and 4.30, respectively. Results of the t-test and ANOVA confirmed statistically significant differences between results before and after the experiment, as well as proved the different impact of the British and Canadian models on the process of digital competence development.

It can be stated that the use of a digital model of digital competences development supports the growth of digital competences, analytical and managerial competences, contributes to pedagogical design competence and helps to build trust in the usage of technologies and increase self-confidence in digital skills. The best results were obtained using the combined model, consisting of online theoretical courses and practical training using models and simulations. On the basis of the above, recommendations have been formulated regarding the introduction of a staged training of teachers to teach using a simulation platform, the development of practical training exercises, and project activities. The limitations of the study relate to the sample size and the online format. Further research should focus on increasing the sample size and improving the range of tools for learning digital technologies.

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